THE INSTITUTE SPOKESMAN

Volume XII • Number 4 • July, 1948

"PRECISION" UNIVERSAL PENETROMETER
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PUBLISHED BY THE
NATIONAL LUBRICATING GREASE INSTITUTE

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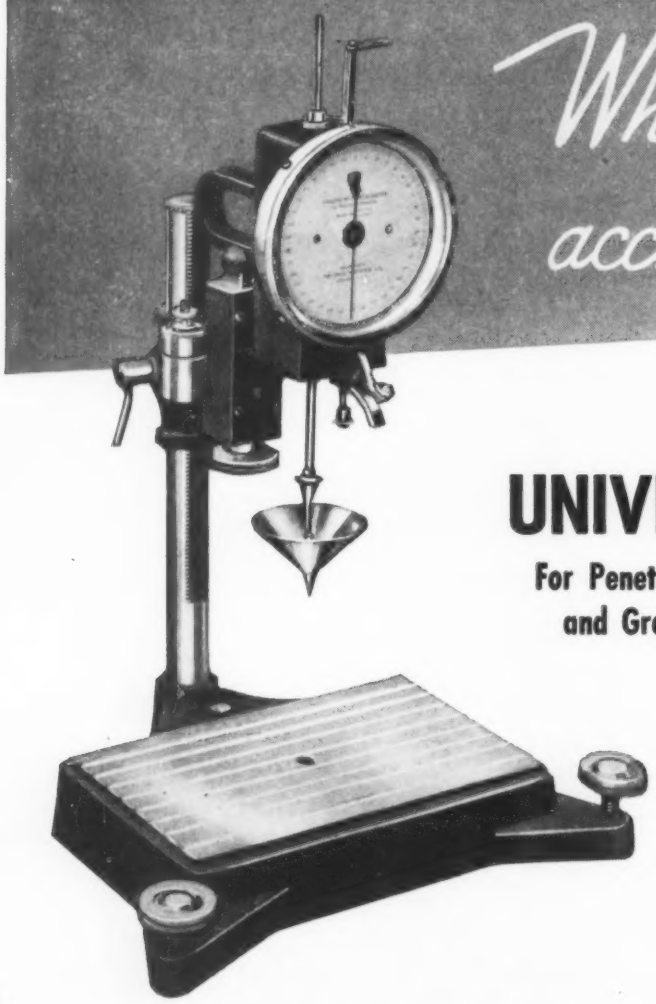
When unquestioned accuracy is essential



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The approximate viscosities of the Vis- ity Standards are as follows:

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ALPHA 48	.....	304	52	...	....	66	8
BETA 48	....	1928	116	92	...	417	24
GAMMA 48	341	36	.....	....	75	3	....

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The INSTITUTE SPOKESMAN

Published monthly by
THE NATIONAL LUBRICATING GREASE INSTITUTE

HARRY F. BENNETTS ..... *Editor*
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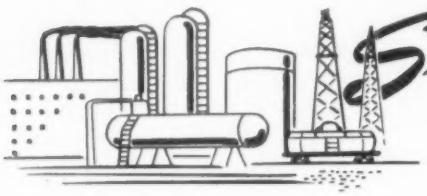

Supply and Demand

FOR LUBRICANTS--UNITED STATES YEARS 1918-1947 FORECAST THROUGH 1951

by ALBERT J. McINTOSH

Paper Presented at the Spring Meeting of the Lubrication Committee of the American Petroleum Institute, in the Mayo Hotel, Tulsa, Oklahoma, April 28, 1948

About the Author

Albert J. McIntosh, economist, Socony-Vacuum Oil Company, Inc., entered the petroleum industry in 1912, at the age of 14 and has been associated with one company in all that time.

Employed as an office boy, Mr. McIntosh completed his high school and college education by attending night school.

In 1917, Mr. McIntosh was given leave by the company to work in the petroleum division of the Fuel Administration. The following year, he entered the Army and served in the coast artillery. Upon his return to the company, he enrolled in New York University and was graduated in 1923 with a Bachelor of Commercial Science, cum laude.

During the NRA days, Mr. McIntosh was a member of the Statistical Committee of Planning and Coordination Committee. During World War II, he was a member of the Petroleum Economics Sub-Committee of the Petroleum Industry War Council and served as chairman of the East Coast Fuel Oil Advisory Committee of the OPA.

Author of several papers for the American Institute of Mining and Metallurgical Engineering, Mr. McIntosh has also been active in the American Petroleum Institute and is serving as chairman of the Statistical Advisory Committee and a member of the recently organized Economic Advisory Committee of the Interstate Oil Compact Commission. He is a frequent speaker at technical and trade association meetings.

SUPPLY AND DEMAND FOR LUBRICANTS – UNITED STATES A

(THOUSAND BARRELS OF 42's DAILY)

ITEM	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	193
PRODUCTION	54.9	55.2	68.1	57.2	63.9	71.6	75.2	85.1	88.5	86.9	94.7	94.1	93.7	73.2	61.3	65.1	7
IMPORTS	-	-	-	-	-	0.1	-	0.1	0.1	-	-	0.1	0.1	0.1	-	-	
ADDITIVES & MISCEL.	1.5	1.6	1.6	1.7	1.8	1.8	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.3	2.1	2.5	2
NEW SUPPLY	56.4	56.8	69.7	58.9	65.7	73.5	77.2	87.3	90.8	89.2	97.1	96.7	96.4	75.6	63.4	67.6	7
STOCK CHANGE	+0.1	-0.1	+1.5	+5.2	-0.3	+0.5	+0.8	+2.3	+0.9	+0.8	+1.3	-0.2	+7.4	-3.6	-2.8	-4.4	+2
TOTAL DEMAND	56.3	56.9	68.2	53.7	66.0	73.0	76.4	85.0	89.9	88.4	95.8	96.9	89.0	79.2	66.2	72.0	7
EXPORTS	16.9	18.1	26.3	19.0	21.8	22.9	24.9	26.5	25.9	26.8	30.1	29.7	27.2	22.3	18.7	22.5	2
INDICATED DOMESTIC CONS.	39.4	38.8	41.9	34.7	44.2	50.1	51.5	58.5	64.0	61.6	65.7	67.2	61.8	56.9	47.5	49.5	5
AUTOMOTIVE TYPE	10.8	11.7	13.9	14.6	16.7	20.5	22.5	26.0	29.5	32.6	35.1	38.7	38.2	36.6	34.4	32.7	3
INDUSTRIAL	28.6	27.1	28.0	20.1	27.5	29.6	29.0	32.5	34.5	29.0	30.6	28.5	23.6	20.3	13.1	16.8	2
MOTOR FUEL CONSUMPTION	219.0	242.9	297.6	320.1	377.4	478.0	537.1	637.7	734.6	836.6	925.9	1 042.6	1 090.6	1 117.0	1 032.2	1 042.4	1 12
TRACTOR FUELS CONSUMPTION	7.4	8.0	9.7	10.2	11.8	14.6	16.1	18.8	21.1	23.6	25.5	28.7	28.2	26.8	24.5	24.9	2
TOTAL CONSUMPTION	226.4	250.9	307.3	330.3	389.2	492.6	553.2	656.5	755.7	860.2	951.4	1 071.3	1 118.8	1 143.8	1 056.7	1 067.3	1 14
RATIO MOTOR OILS TO FUELS	4.76	4.66	4.53	4.41	4.30	4.17	4.06	3.95	3.90	3.79	3.69	3.61	3.41	3.20	3.26	3.06	2
F.R.B. PRODUCTION INDEX	77	72	75	58	73	88	82	90	96	95	99	110	91	75	58	69	

(a) INCLUDES ESTIMATED MILITARY EXPORTS 1.0 T.B.D. AND (b) 0.4 T.B.D.

I. McIntosh, Economist, Socony-Vaccum Oil Company, Inc.

There appears to be sufficient capacity in the United States at present to produce lubricants to take care of any demands on the country which we foresee through the year 1951. Nevertheless, we have been informed, as the result of a carefully detailed plant by plant study, that during the next two years there will be completed in the U. S. plants which will add to the capacity around 16,000 barrels a day of finished lubricant production. This will mean over 10% more capacity than is now available in the U. S.

Demand

On Table No. 1 we show the official Bureau of Mines figures for the production of "lubricants" from crude oil as reported each year. By applying stock changes, we determine the total amounts disappeared, or supposedly consumed, but the figures really represent shipments from refineries. For our purpose we have added to these orthodox figures either actual figures or estimates of the quantities of additives blended into oils or greases commonly sold by lubricating departments. We have also reached over into some parts of the "Miscellaneous" products and found White Oils, Petrolatums and Absorbtion Oils which we think more properly or conveniently should be combined with other lubricants. We have shown these estimates separately.

(Continued on page 6)

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ATED DATA YEARS 1918-1947 AND FORECAST THRU 1951

1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	ITEM
96.8	84.5	96.0	100.5	108.3	105.8	106.0	112.3	114.7	125.1	141.8	142.8	141.9	143.9	140.8	PRODUCTION
-	-	-	-	-	-	-	-	-	0.2	0.1	-	-	-	-	IMPORTS
2.9	2.7	3.0	2.9	3.2	3.1	3.5	3.5	3.6	3.6	4.1	4.2	4.2	4.2	4.1	ADDITIVES & MISCEL.
99.7	87.2	99.0	103.4	111.5	108.9	109.5	115.8	118.3	128.9	146.0	147.0	146.1	148.1	144.9	NEW SUPPLY
+2.8	+0.5	-1.5	+4.4	-1.8	+3.5	-4.5	+0.1	-0.1	-0.6	+2.9	-	-	-	-	STOCK CHANGE
96.9	86.7	100.5	99.0	113.3	105.4	114.0	115.7	118.4	129.5	143.1	147.0	146.1	148.1	144.9	TOTAL DEMAND
30.1	25.8	32.5	28.6	27.2	22.7	24.3	23.8	19.0 (a)	30.7 (b)	39.0	40.0	41.0	42.0	43.0	EXPORTS
66.8	60.9	68.0	70.4	86.1	82.7	89.7	91.9	99.4	98.8	104.1	107.0	105.1	106.1	101.9	INDICATED DOMESTIC CONS.
34.6	33.4	33.9	35.5	39.0	35.2	32.6	35.3	46.0	56.7	60.1	60.3	60.4	61.0	60.2	AUTOMOTIVE TYPE
32.2	27.5	34.1	34.9	47.1	47.5	57.1	56.6	53.4	42.1	44.0	46.7	44.7	45.1	41.7	INDUSTRIAL
1 402.9	1 432.9	1 513.9	1 610.6	1 828.5	1 600.1	1 498.8	1 538.2	1 731.4	2 014.8	2 177.6	2 269.0	2 360.0	2 478.0	2 552.0	MOTOR FUEL CONSUMPTION
34.9	36.0	37.5	39.9	38.7	40.7	40.1	43.3	40.5	44.4	47.5	52.0	56.0	62.0	66.0	TRACTOR FUELS CONSUMPTION
1 437.8	1 468.9	1 551.4	1 650.5	1 867.2	1 640.8	1 538.9	1 581.5	1 771.9	2 059.2	2 225.1	2 321.0	2 416.0	2 540.0	2 618.0	TOTAL CONSUMPTION
2.37	2.27	2.18	2.15	2.09	2.14	2.12	2.24	2.60	2.75	2.70	2.60	2.50	2.40	2.30	RATIO MOTOR OILS TO FUELS
113	89	109	125	162	199	239	235	203	171	187	185	175	177	160	F.R.B. PRODUCTION INDEX

TABLE No. 1

SUPPLY AND DEMAND

(Continued from page 5)

For several years the API has been using these same adjustments. So from these statistics we arrive at what we call "Total Demand" figures.

Exports are currently reported by the Department of Commerce and carried in the Bureau of Mines reports so we can arrive at a "Domestic Demand" by deduction.

Many persons are interested to know the breakdown of the Domestic Demand into automotive type lubricants and other or industrial, types. There are no actual figures on this subject. All are estimates. Maybe next year when the industry gets the results of the survey now being conducted by the Department of Commerce for, and at the expense of, the industry through the API, we will know more closely what the real breakdown is. Just how good these results are depends largely upon the cooperation of the industry in carefully completing the questionnaires already in their hands. I urge you all to get behind this effort because it is your money which is being spent and the survey was designed for your benefit. Figures for each state will be available.

We have been estimating this breakdown each year in a detailed fashion, but it is still an estimate. We start by estimating the automotive type oils. The results are shown on Table No. 1.

The other, or industrial uses are arrived at by subtraction.

The table also shows gasoline and tractor fuels consumed so that the ratios could be shown for motor oils and greases to fuels used. Also the F.R.B. Index of Industrial Production is shown to compare with the indicated industrial lubricants consumed.

Graph No. 1 shows the history and forecasts of the three major classifications of lubricants consumed, e. g. Exports, Domestic Automotive Type and Industrial.

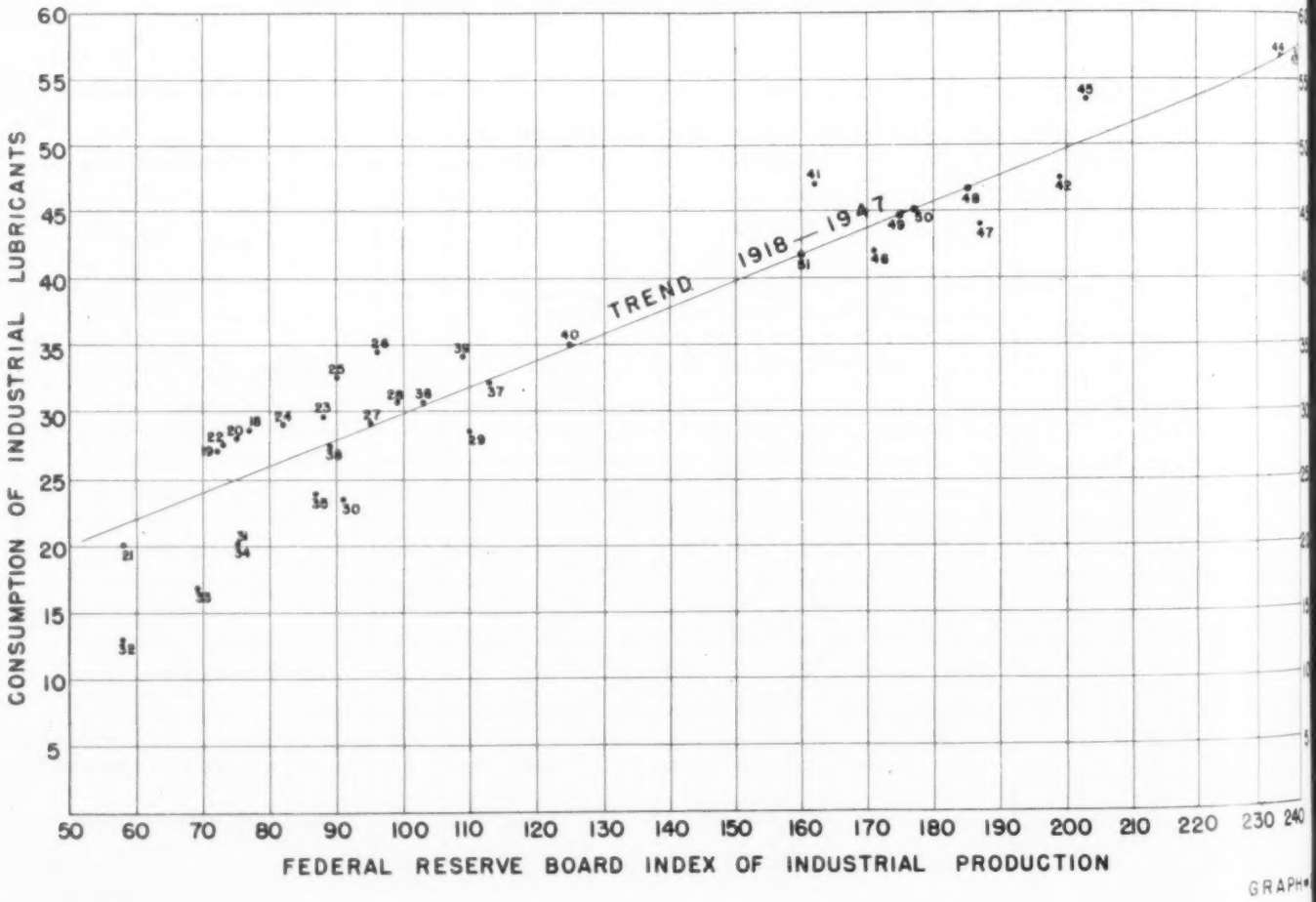
Graph No. 2 shows the history of industrial lubricants consumed and the relation with the F.R.B. Production Index. It shows a fairly good relationship as we believe it should.

Forecast

Motor fuel consumption has been forecast at modest increases over the next few years while tractor fuels have been shown as increasing twice as rapidly. Y

(Continued on page 8)

CORRELATION BETWEEN CONSUMPTION OF INDUSTRIAL LUBRICANTS IN THE U.S. AND THE F.R.B. INDUSTRIAL PRODUCTION INDEX



GRAPH

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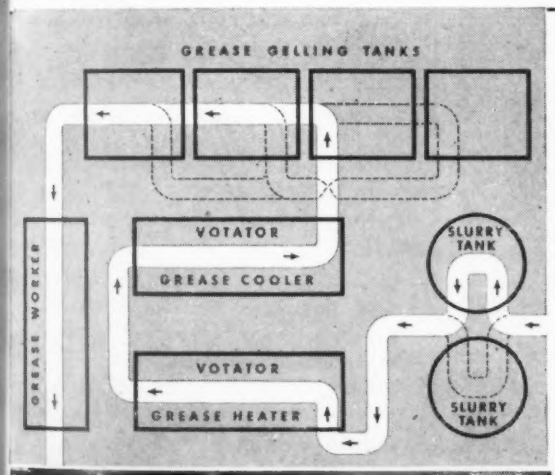

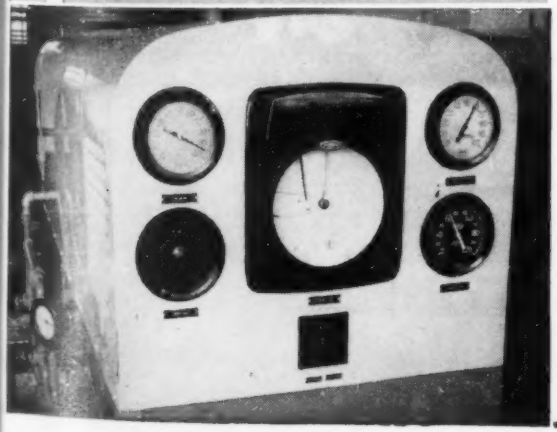

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SUPPLY AND DEMAND

(Continued from page 6)

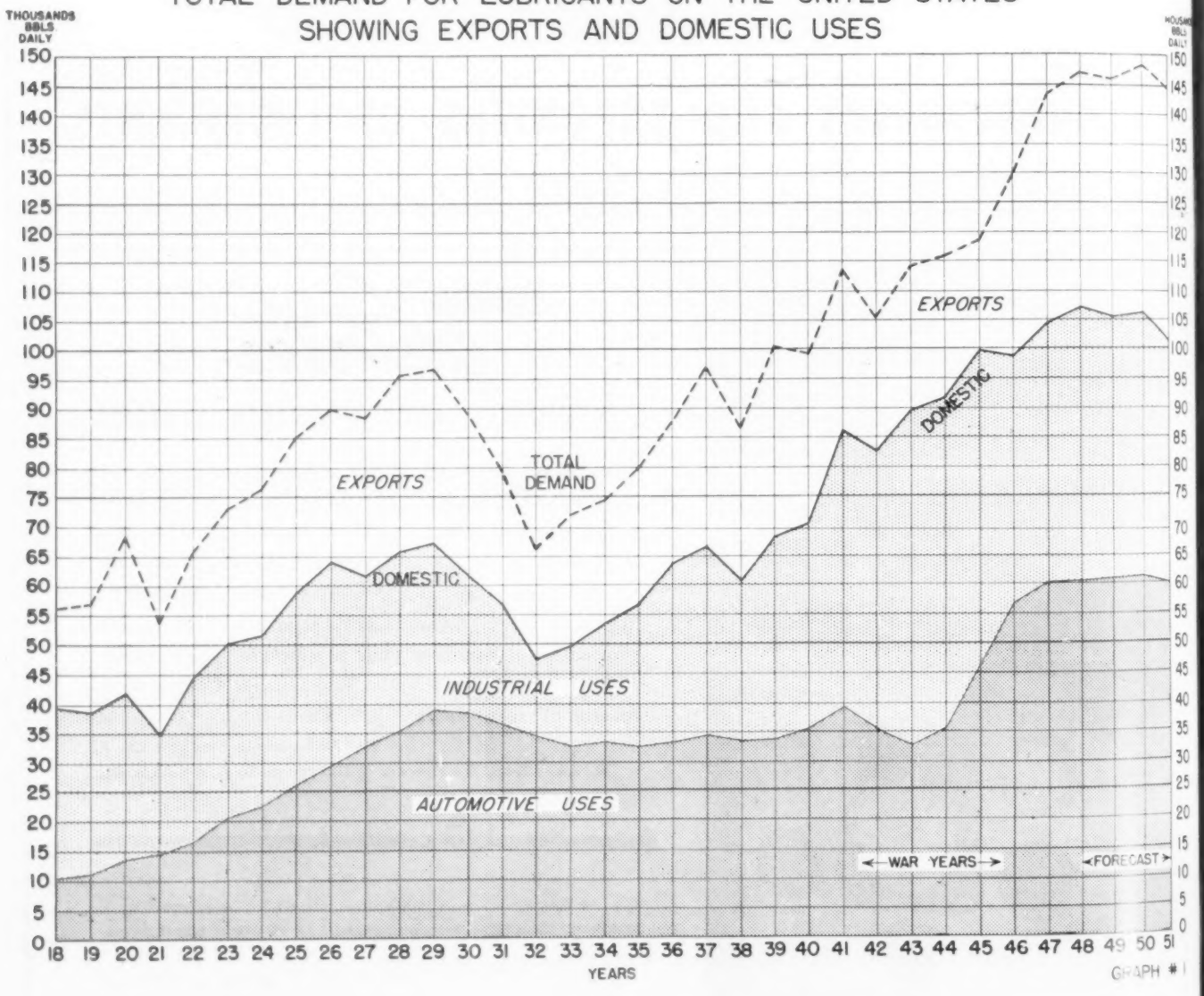
will note that we forecast a decline in the ratio of motor oils and greases to these fuel estimates. Because of the greatly increased average age of cars and insufficient solvent treating capacity to make all the premium quality oils desired, these ratios grew rapidly during the war. The sale of new cars and the competition of the highest quality products should gradually reduce these ratios. We have, therefore, indicated a declining ratio over the next few years. This decline approximately offsets the requirements for additional cars.

The forecast for industrial lubricants are strictly mathematical on the trend line from Graph No. 2 and are based on my conception of the business activity as measured by the F.R.B. Index. We look for a modest decline over the next few years culminating in a sharper decline to the 1941 level by 1951. For every 10 point difference in the forecast of production as measured by the F.R.B. Index, we add or deduct about 2,000 barrels a day for the consumption of industrial lubricants. This has held fairly well in the past and may provide a workable basis for forecasting.

Adding the results together, we find that the consumption in 1948 may be a peak and may not be exceeded during the next few years.

Exports

Demands in the foreign f[illegible] from 19[illegible] to 1951 may increase abou[illegible]0,000 ba[illegible] rels a day. There are avail[illegible]le estimat[illegible] for the lubricating require[illegible]nts of t[illegible] Marshall Plan countries, b[illegible] questio[illegible] have been raised as to w[illegible]ether th[illegible] volumes may be reached. The requir[illegible] ments in other countries are much mo[illegible] speculative. We have studied these pr[illegible] blems and have come up with the abo[illegible] increase. We have even less informati[illegible] on expansion in foreign plants for t[illegible] production of lubricants. Plans are t[illegible] uncertain, delays too frequent to get a[illegible] reliable figures. We have assumed, ther[illegible] fore, only a small increase in exports fr[illegible] the U. S. rising at 1,000 barrels a [illegible]



ring each year. Some persons think if anything I may be high, particularly during 195[illegible]. There will be sufficient capacity to do much more as we shall see in detail later.

Total Demands and Required Refinery Output

We have now arrived at a point where we can set down all the forecasts and total them up. Here's what we see.

(1000's Bbls. Daily)

		*Required Production from Crude in U. S.
[illegible]		141.8
1948	Forecast	142.8
1949	"	141.9
1950	"	143.9
1951	"	140.8

If my exports are too high and my industrial consumption in the U. S. is too low, you might very well come up with the same results. Current exports data do not indicate any increased exports, but some allocations may still be in effect.

Capacity

The theoretical capacity which was ob-

(Continued on page 24)

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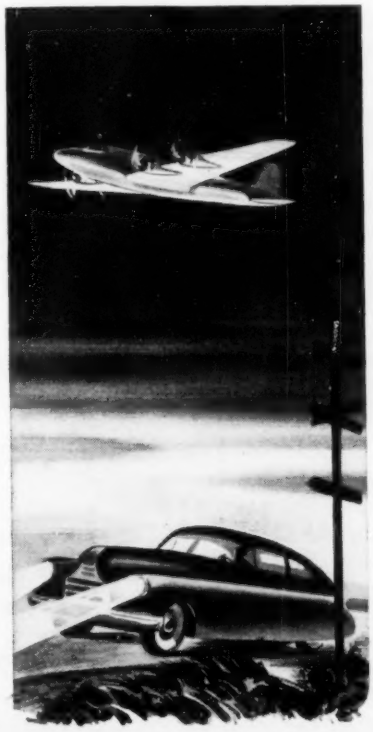

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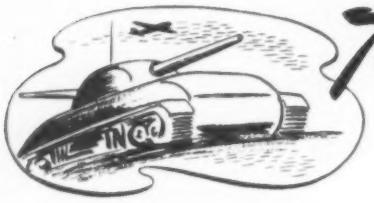

The Armed Services

PRESENT AND FUTURE LUBRICANT REQUIREMENTS

by COLONEL G. H. VOGEL, QMC

Paper Presented at the Spring Meeting of the Lubrication Committee of the American Petroleum Institute, in the Mayo Hotel, Tulsa, Oklahoma, April 28, 1948

About the Author

Colonel Vogel was born in Nevada on September 5, 1900. In 1920 he graduated from the United States Military Academy at West Point with a Bachelor of Science Degree.

In the interval between the two World Wars, Colonel Vogel took advantage of the Army system of Service schools and graduated from the Coast Artillery School Basic Course in 1921, the Coast Artillery Battery Officers' Course in 1926, the Quartermaster Corps Motor Transport School in 1931, and the command and General Staff School at Fort Leavenworth in 1940. He was detailed by the Army to the University of Michigan, from which institution he received a Master of Science Degree in 1936 and where he was elected to membership in Phi Kappa Phi.

Just prior to the entry of the United States into World War II, Colonel Vogel was specializing in motor transportation for the Office of the Quartermaster General. In 1942 he was sent overseas.

Colonel Vogel was assigned to the Petroleum Section in London, and starting from the beginning he built the organization which later supplied all petroleum products for the African, Sicilian, Italian and Southern France invasions. The Petroleum Section of Allied Force Headquarters, of which Colonel Vogel was Chief, was charged with the heavy responsibility of supplying all petroleum products for the Armies, Navies and Air Forces of the United States and our Allies in the Mediterranean Theater, as well as for the civilian population of the liberated and occupied areas. The work of the Section was so satisfactorily executed that it can be said that in the Mediterranean Theater no operation was ever delayed due to lack of petroleum.

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Colonel Vogel's efforts were recognized and rewarded by the United States Government, which presented him with a Distinguished Service Medal and two Legions of Merit. He was also presented with Commendation Ribbons from both the Army and the Navy. Britian rewarded him with one of its highest decorations, the Order of the British Empire, and France conferred upon him the Legion d' Honneur and the Croix de Guerre with Palm.

After Colonel Vogel returned from forty months' overseas service, he became Assistant to the Executive Officer of the Army-Navy Petroleum Board. He now occupies the position of Executive Officer of the Board which is now the Armed Services Petroleum Board.

The Armed Services Petroleum Board is sincerely appreciative of the opportunity to present to the American Petroleum Institute the military requirements for lubricants.

Our current and future problems are many. Continued initiative, guidance, and productivity in research and development will be required.

The transition of industry at the end of hostilities was so difficult in many ways as the change from peacetime to war production. The military services recognize this achievement and congratulate industry for its accomplishments.

Today world affairs require preparedness by industry and the military services.

Some of the problems of the military and the progress to date in solving them will be discussed. These are not necessarily new to you, but the fact that they remain problems is indicative of the fact that additional coordinative effort is required.

Few industries have a growth curve comparable to that of industrial research during the last quarter of a century. In fact, scientific research is one of our major industries that must keep years ahead of the forces of production.

The war increased appreciation of the value of research and gave it an impetus that brought developments since Pearl Harbor that could hardly have been expected in two decades at normal peacetime rates.

Processes which for years had lain dormant in chemical reports because they were not economically feasible at the

(Continued on page 12)

SOUTHWEST FOR Good GREASE

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BALCRANK
LUBRICATING EQUIPMENT
BALCRANK INC. CINCINNATI 9, OHIO

THE ARMED SERVICES

(Continued from page 11)

time were applied to commercial operation. War removed the economic barriers; unprecedented progress was made in plant designs and refining techniques which resulted in improved fuels and lubricants as well as a whole line of petroleum derivative products.

The present effective refining capacity for lubricating oil in the United States is approximately one hundred fifty thousand barrels per day. Under construction are solvent extraction and solvent dewaxing units with an estimated output of forty thousand barrels per day. Some of this newly constructed capacity will undoubtedly replace present operating units, but the total effective capacity by nineteen hundred fifty should be adequate for our peacetime requirements.

The requirements of the military services and other Federal agencies for all lubricating oils for the fiscal year nineteen hundred forty nine are approximately one million three hundred thousand barrels or roughly thirty six hundred barrels per day. In an emergency this requirement of thirty six hundred barrels per day would probably be increased five times and depending on the ability of industry to produce war material requiring lubrication, this daily consumption might reach thirty six thousand barrels of lubricating oil.

These figures do not include the Civil Affairs requirements for Europe and the Pacific which are estimated at approximately seven hundred thousand barrels for the fiscal year of nineteen hundred forty nine.

The availability of the most desirable crudes for the manufacture of lubricants is an increasing problem. Plans for the future must include consideration by the refiners of transporting desirable crudes from longer distances, and of processing less desirable crudes, resulting in lowered yields for a given charge capacity.

Any material increase in consumption by the military services must be met by one or a combination of the following:

a. Increased efforts to make available additional quantities of desirable and usable crudes.

b. Operation of all refining capacity at the maximum rate possible.

c. Reduction of civilian consumption.

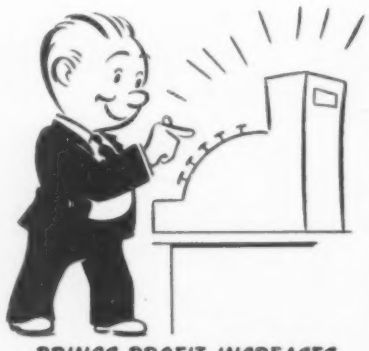
d. Expansion of refining capacities.

The United States Air Forces and the Navy Bureau of Aeronautics require that their aircraft have an ambient temperature operating range from minus sixty five degrees Fahrenheit to plus one hundred sixty five degrees Fahrenheit.

Reciprocating aircraft engines operating at the higher temperatures generally utilize aviation lubricating oil grade eleven twenty. Grade eleven hundred is generally used for cold weather operations with the oil viscosity requirement for satisfactory starting being met by dilution with aviation gasoline.

Operation of aircraft with reciprocating engines could be greatly facilitated if one grade of oil were developed that would permit satisfactory starting and

BAT'S LINE OF GREASES



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eration through the required temperature range.

Turbo-jet engines require a very low viscosity lubricating oil. The lowest viscosity petroleum oils now being used have pour points below minus sixty five degrees Fahrenheit but in some installations the oil is too viscous to permit pumping at temperatures below minus forty to minus fifty degrees Fahrenheit.

The turbo-prop engine provides the most stringent requirements of any aircraft power plant on a lubricating oil.

(Continued on page 16)

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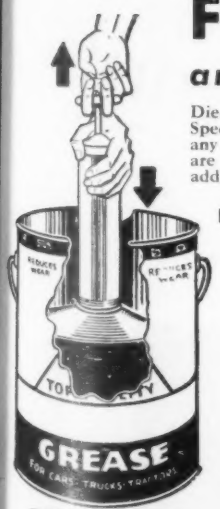

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CHAIRMAN T. G. ROEHNER, "DIRECTOR OF THE TECHNICAL SERVICE DEPARTMENT, SOCONY-VACUUM LABORATORIES."

- **PANEL STUDIES DELIVERY CHARACTERISTICS.**
- **EXPLORATORY PROGRAM.**
- **NO DELUSIONS ABOUT WORK.**
- **NO DOUBT EXPRESSED.**

The Technical Committee's Panel studying the delivery characteristics of dispensing equipment for lubricating greases met on June 2nd, in Chicago. The following were present:

T. G. Roehner—(Chairman)—Socony-Vacuum Oil Co., Inc.

B. A. Beaver—Gray Company, Inc.

H. F. Bennetts—National Lubricating Grease Institute.

L. C. Brunstrum—Standard Oil Company (Indiana).

N. W. Faust—The Texas Company.

R. P. Field—Balcrank, Inc.

H. L. Hemmingway—Pure Oil Company.

R. G. Moyer—Pure Oil Company.

C. H. Mueller—Lincoln Engineering Company.

W. H. Oldacre—D. A. St[illegible] Oil Co. Ltd.

C. F. Raisch—Alemite Divisi[illegible], Stewart-Warner Corp.

H. R. Tear—Alemite Divisi[illegible], Stewart-Warner Corp.

G. A. Williams—Battenfeld [illegible]rease & Oil Corp.

S. J. Zielinski—Alemite Division, Stewart-Warner Corp.

It was apparent that the Panel has a healthy respect for the problems which must be solved before the objective can be attained. This objective, it will be recalled, is the *development of a method for defining the operating ranges of grease dispensing equipment in terms of the physical characteristics they will handle.* The Panel agreed that the problem should be sub-divided and that attention should first be focused on chassis greases and on air operated, high pressure guns and fittings of the type commonly employed in service stations and for truck and bus fleet operations.

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MONSANTO
CHEMICALS AND PLASTICS

The following program was outlined on an exploratory basis:

A. Three greases were selected for these exploratory tests—

Greas Code Designation	Source	Type Reresented
GI No. 20	Brunstrum	Cup or Buttery
GI No. 21	Roehner	Viscous
GI No. 22	Faust	Fibrous

Hundred pound drums of these greases re to be furnished to each gun manufacturer represented on the Panel.

B. The guns used will be air operated, gh pressure (100 lb. drum) guns, fitted th 7 feet of ¼ inch I.D. hose having swivel joints and one control valve. ch member will work with one gun and grease laboratories represented are to supplied by the gun manufacturers represented.

C. The air pressures will be 90 to 150 lbs.

D. The test temperatures will be 32°F., 0°F. and room temperature. The temperatures will be determined at the suction stub and the soaking time of greases and equipment at 32°F. will be 72 hours.

E. Delivery rates will be recorded as ounces per minute. No screens will be used.

F. The greases will be recorded in terms of their unworked penetrations and apparent viscosities at the test temperatures. The former will indicate the probable rate of priming of the pump and the latter will be tied in more directly with rates of flow. Yield values of the grease may also be obtained to correlate with unworked penetrations.

The Panel is under no delusions concerning the amount of work involved and later will enlist the assistance of

(Continued on page 24)

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THE ARMED SERVICES

(Continued from page 13)

This engine has the basic tubro-jet engine lubrication problem in the power section with the added requirements for lubricating reduction gears transmitting tremendous power.

A high viscosity index, low pour point oil is desired for lubrication of the turbo-jet and turbo-prop engines and for the latter, extreme pressure qualities are required. For either power plant, dilution is not desirable due to the exceedingly low heat rejection to the lubricating oil.

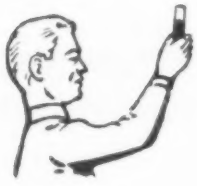
Extensive research is being conducted and will be continued until more desirable lubricants are developed for all aircraft engines. For the turbo-jet and turbo-prop engines the application of synthetic oils appears promising.

During the winter of nineteen hundred forty six to nineteen hundred forty seven, it became evident to the Department of the Army that their military equipment, using the specified lubricants according to issued instructions, could not operate successfully below minus forty degrees Fahrenheit. A meeting of key personnel from the refining and manufacturing companies and representatives of the Ordnance Department was called to discuss the requirements for lubricants that would permit operation of military equipment at temperatures down to minus sixty five degrees Fahrenheit.

Adequate quantities of each special lubricant selected by this committee were manufactured and forwarded to Aberdeen Proving Ground and screened for performance in military equipment at the then prevailing temperature of sixty to seventy degrees Fahrenheit. Sufficient quantities of the remaining lubricants and the necessary transport and combat vehicles were then forwarded to Elgin Air Base, Florida, and evaluated in the climatic hanger by testing the operation of the equipment under Artic temperatures. Upon completion of these tests, supplies of the acceptable products were immediately shipped to Alaska and issued to the entire theater for general field test use. Field tests were under the constant supervision of the Ordnance Department and leaders in industry working under the auspices of the Coordinating Research Council who alternated as observers and advisors.

After approximately six months operation of the equipment over the entire theater, at temperatures ranging down to minus forty five degrees Fahrenheit a convoy of vehicles was assembled and driven from Alaska to the Detroit Arsenal. Some of the convoy vehicles were serviced with regular lubricants and the remainder with the low temperature products. Final inspection of the vehicles revealed that the performance of the Artic fuels and lubricants was satisfactory. The result of these tests will provide information to the military services and industry which will enable them to materially improve the operation of military equipment in the Artic.

While the initial information indicates that the performance of these special lubricants is generally satisfactory, considerable additional effort will be required before a final solution is obtained.



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To service test these lubricants, screen them, and verify their suitability, a twenty thousand mile road test will be carried out. A convoy is scheduled to leave the east coast in August, ninteen hundred forty eight, operate several thousand miles in the western desert, then proceed to Alaska by way of the Alcan Highway for winter operations and return to the States for final inspection. Additional materials to be tested may include tires, brake linings, sealed brakes, spark plugs, fan belts, brake fluid, and

(Continued on page 19)

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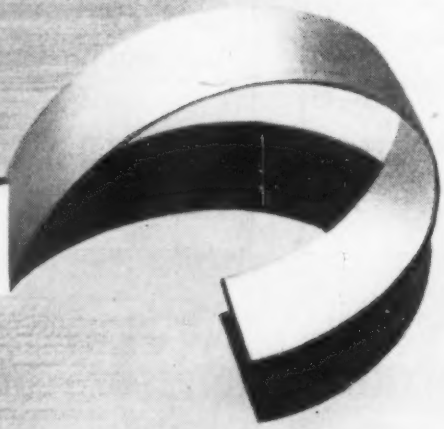

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THE ARMED SERVICES

(Continued from page 17)

bers. All technical aspects of this con- operation are under the jurisdiction the Ordnance Department of the my, assisted by the Coordinating Re- rch Council. This Army-Coordinat- Research Council team is one of the standing examples of military-indus- cooperation.

The military services are looking for- rd to the completion of cold weather ts now being conducted by the United States Naval Arctic Test Station located at Point Barrow, Alaska. This operation is in the United States Naval Petroleum Reserve Number Four under the technical supervision of the Naval Research Laboratory. The Station is continuing extensive tests covering operations and maintenance problems peculiar to the Artic. Under test are engine lubricants, transmission and differential gear lubricants, hydraulic fluid, brake fluid, chassis, wheel bearing, roller pad, track and general greases including the Arctic materials developed by the Ordnance Department of the Department of the Army and the application of these products in the available equipment.

Extensive research is being conducted by the military services on lubricants. This work ranges from development work dictated by needs revealed during World War II to fundamental research. Substantial improvements have been made in the development of low temperature lubricants with decreased torque requirements at temperatures below minus forty degrees Fahrenheit, lower evaporation rates, and improved storage stability. The Naval Research Laboratory, after extensive research, reports that excellent low temperature greases can be prepared from diesters, silicones and silicone-diester mixtures, thickened with lithium stearate. These greases exhibit extremely low torques in anti-friction bearings at temperatures as low as minus on hundred degrees Fahrenheit and remarkably low evaporation rates at moderately elevated temperatures. This work led to the specification AN-G-25, a potential universal grease, possibly requiring some improvement in wear characteristics and an extension of the high temperature range to make it the truly universal grease for aircraft.

The Naval Research Laboratory, conducting research sponsored by the Bureau of Ordnance, has developed an oil and a grease for fire control instruments from diesters. These lubricants with improved stability will permit satisfactory performance over a wide temperature range for some fire control instruments. Research will be continued to improve the performance characteristics of these lubricants.

The Ordnance Department, Department of the Army, has extensive research projects to develop one instrument oil and one grease that will assure maximum performance of fire control instruments and

(Continued on page 20)

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THE ARMED SERVICES

Continued from page 19)

Signal Corps aerial cameras and meterological equipment over a temperature range of minus sixty five degrees Fahrenheit, to plus one hundred sixty degrees Fahrenheit, and which will possess high stability for service conditions.

The Air Materiel Command, United States Air Force, states that for the immediate future, grease lubrication of aircraft will be limited to four greases that formance ranges to take care of all present requirements and almost any eventuality in future designs.

The military services require an increasing number of specialized type of equipment, each of which makes more complex the problem of supplying satisfactory lubricants. This problem is recognized. Continued effort is being made to increase the application and temperature range over which lubricants can successfully operate. The results are reflected in the combining of the different requirements into joint specifications and the cancellation of those no longer required. A reduction in the number of products required will simplify the manufacturing problems for industry and the logistics problems for the services.

An important job for the future in connection with the development of greases and lubricating oils, of the petroleum and synthetic types, is the necessity of greater correlation between service-performance and laboratory-performance tests, together with refinement of laboratory methods for greater reproducibility.

Equipment supplied by industry to the military is serviced by the manufacturer with lubricants fully meeting the requirements of the service involved. It is mandatory that as the needs of the services develop, industry be given complete information concerning them so that satisfactory products may be developed. This makes the exchange of information between the military services and industry increasingly necessary, a procedure which will result in increased availability in case of emergency.

The military service grease requirement for the fiscal year of nineteen hundred forty nine is approximately ten million pounds. The actual consumption will be above that estimate as considerable stocks of some types are on hand. The grease requirement for Civil Affairs for the same period is estimated at twelve million pounds.

The grease manufacturing capacity is apparently adequate. The supply of some materials required for specialty greases may not be. The military services have experienced difficulty in obtaining from industry adequate coverage for their requirements of small quantities of special oils and greases.

Industry should appreciate the military position regarding these comparatively small volumes of special products. The requirements have been established through extensive research and sufficient quantities must be available to successfully operate the equipment for which they were developed.

The degree or extent of deterioration of stored lubricants and greases should be determined for each product under varying atmospheric conditions. This change with length of storage should be determined and its effect should be evaluated in terms of useability. This basic information should be provided for all petroleum products and synthetic lubricants

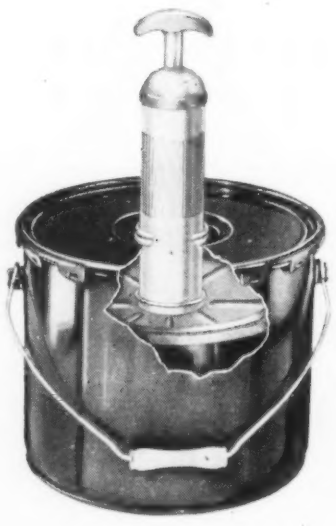
to allow the military services to stock pile as dictated by needs, products availability and transportation.

Gummy deposits resulting in ring sticking promoted research that developed additive type oils for use in diesel engines. These additives include: oxidation inhibitors, corrosion inhibitors, compounds for improving the lubricity of the oil, compounds for improving the low temperature characteristics and detergents which resist the formation of insoluble sludges. The development of the "vapor phase" or high temperature system of cooling diesel engines, of high speed for all applications, of the combination diesel gas-oil engine, of synthetic diesel fuel oils, the utilization of heavy diesel fuels, of higher sulfur fuels, in keeping engines warm by idling at Arctic conditions; all of these and other conditions and developments make it mandatory that the present requirements of diesel lubricants be continually re-evaluated.

In so far as the United States is able to continue meeting its needs from domestic sources, it must increasingly "stretch" its

(Continued on page 21)

INLAND STEEL CONTAINER COMPANY OFFERS NEW GREASE GUN FILLER PAIL



The Inland KLEEN-FIL Grease Gun Filler Pail

A new patented combination grease pail and follower plate, put on the market by the Inland Steel Container Company, is called the Inland KLEEN-FIL grease gun Filler Pail.

The method of attaching the follower plate to the cover was designed to save time and labor when filling the pails with grease. No separate handling is necessary because cover and plate come off as a unit.

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Company name, trade mark and sales message may be lithographed on the pail and the pail may be obtained in standard colors. Literature on the new KLEEN-FIL pail is available upon request to the Inland Steel Container Company, 6532 So. Menard Avenue, Chicago 38, Inninois.

ailable proved reserves by achieving eater recovery of oil from the reservoirs, prove additional reserves by improving finding techniques, exploring new areas, including the continental shelf, and bring into the picture synthetic liquid fuels and lubricants from natural gas, shale, coal and other sources.

The quantity of oil recovered by primary methods of production may be materially increased by cycling operations and pressure maintenance. The recovery of crude oil from pressure depleted fields

(Continued on page 23)

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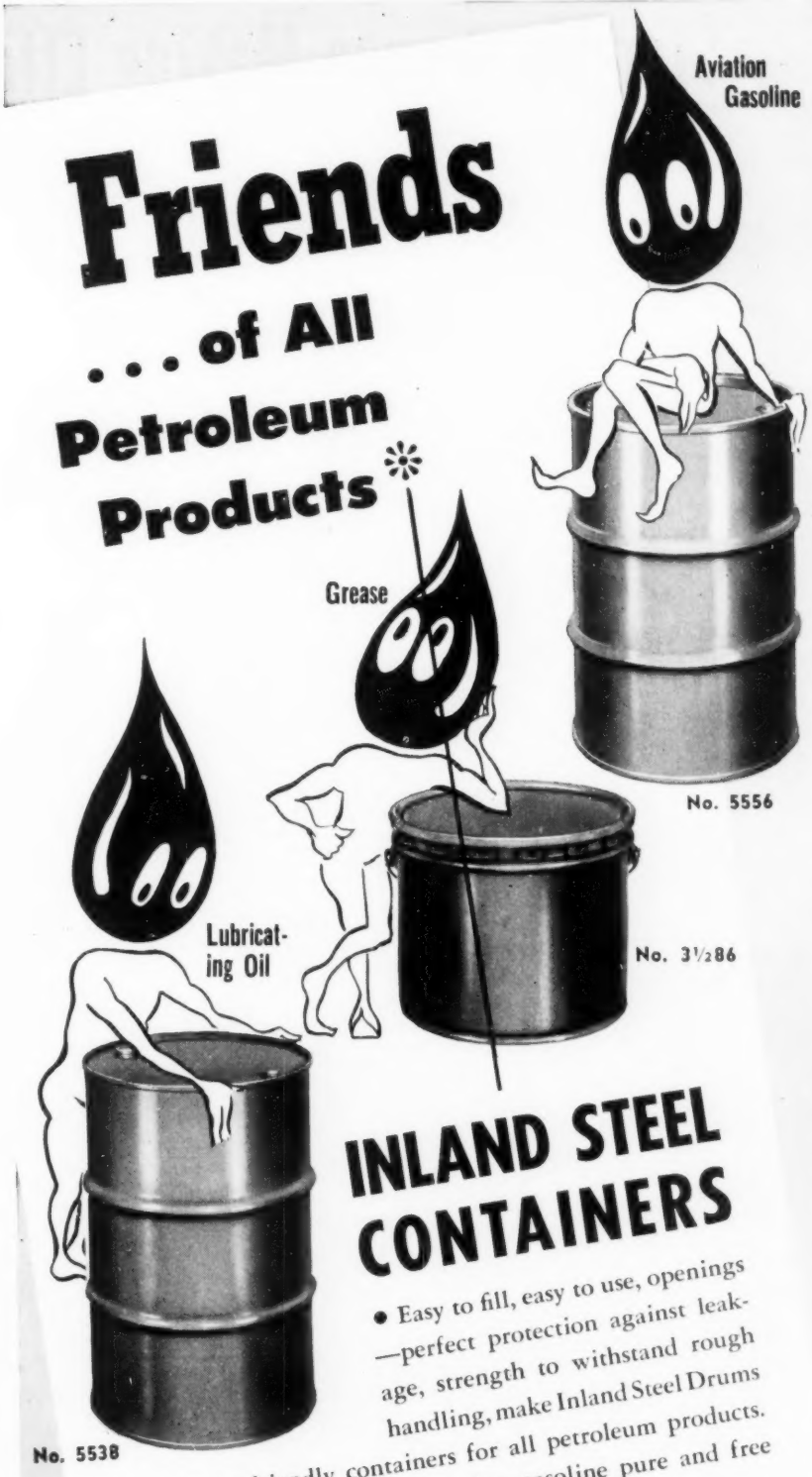

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THE ARMED SERVICES

(Continued from page 21)

by the application of present secondary recovery methods may be equivalent to the volume recovered by primary production methods.

If cycling operations, pressure maintenance, and secondary operations are to be economically feasible, such operations must be for the entire field under a unitization plan.

It is becoming more and more evident to the military that barriers to unitization must be removed and more economic and efficient plans for recovery be developed to increase the ultimate yield from our proven reserves.

In the meantime, practical economics indicate that the nation is finding it expedient and desirable to meet a considerable part of its future petroleum requirements from crude produced in foreign fields. These foreign sources are useful in an emergency only when the fields are free to produce and the supply lines to the refineries and points of redistribution and consumption can be maintained. Canada, Mexico and South America are the more strategically located foreign sources of crude, but, in a national emergency, the military may find it obligatory to defend such sources of petroleum and petroleum products that are essential, no matter where they are located.

- - IF YOU DON'T ATTEND THE ANNUAL MEETING OCT. 11-13

In summation, it is the opinion of the military services that industry has substantially sufficient capacity to manufacture the lubricants that will be required for the military and civilian economy for the immediate future. This capacity may not be adequate in case of a national emergency.

The immediate future is the period for improvement. The supply of raw materials should be augmented, techniques improved, composition of present products, re-evaluated new materials evaluated, new products developed, and a further reduction effected in the number of necessary products.

In order to accomplish closer cooperation and exchange of information, all military information on lubricants will be made available to you to the extent that security permits.

The military service appreciates your interest, support and understanding of its problems.

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SUPPLY AND DEMAND

(Continued from page 9)

tained in the U. S. in 1947 was 158,000 barrels a day. That is the total of the top production in each district in the U. S. The top month for the U. S., as a whole, was 149,000 in May. Since then capacity has been added. Therefore, I believe the country can make 162,000 barrels a day of finished and blended (including additives and miscellaneous oils) lubricants. It is also safe to allow for about 5% below maximum demonstrated capacity to get good annual average capacities, so the 162,000 barrel figure would be reduced to 153,000 as of January 1, 1948. The forecasts of these capacities over the next few years follows.

Year	Capacity January 1st (1000's Bbls. Daily)	Average For Year (1000's Bbls. Daily)
1948	153.9	157.9
1949	161.9	165.9
1950	169.9	(a)170.0
1951		(b)170.0

(a) One-half of any 1950 completions should be added.
(b) All of 1950 completions should be added, plus one-half of any 1951 completions.

Comparison of Capacity and Demand

The opening statement said capacities to produce were presently in place to take care of any foreseeable demand through 1951. Note the following:

(1000's Bbls. Daily)

Year	Total Demand on U. S.	Capacity to Produce (Including Blending Additives and Miscellaneous)
1947	146	(a)153
1948	147	158
1949	146	166
1950	148	170 +
1951	145	170 +

(a) Average for month of May, plus 4,000 additives and miscellaneous.

The outlook is that there will be sufficient capacity to take care of a considerable expansion in demand from present levels with another 16,000 barrels of capacity being installed over the next two years. No probable deviations in the forecasts of demand would change this general conclusion.

Quality

We do not have sufficient data to state definitely that all the various kinds of lubricants will be in equal balance. Inquiries which I have made seem to indicate that there is little concern in the industry on this score.

War or Peace

All of these forecasts are based upon a continuation of general peace conditions such as we now have, over the coming four years. We did not have any forecast of military needs, but we doubt that any changes in these would materially alter our general conclusions.

TECHNICAL COMMITTEE

(Continued from page 14)

more personnel interested in this problem. There was no doubt expressed regarding the need for attaining the above objective and it was evident that the assignment will be given sound support. The date of the next meeting of the panel was left open pending the outcome of the exploratory program. In the mean time the Panel would welcome any comment anyone may offer.

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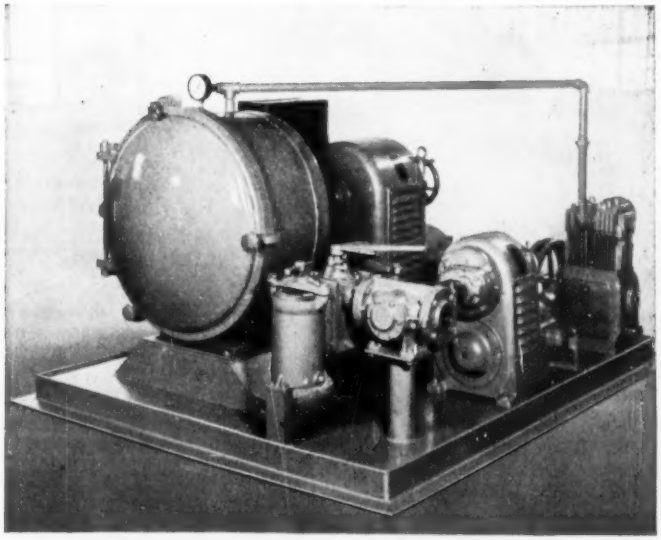

Grease Homogenizer, showing feed pumps, strainers and vacuum pump.

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